TRANSACTIONS
OF THE
ILLUMINATING ENGINEERING SOCIETY

FOUNDED IN LONDON 1909

INCORPORATED 1930

CONTENTS

	Page
A Polar Distribution Calculator, by H. V. Shurmer, M.Sc.	81
Cinema Auditorium Lighting, by J. S. Smyth, B.Sc., A.M.I.E.E., *(Fellow)*	92
Notice of Annual General Meeting	95
Register of Lighting Engineers	95
Report of the Council (January 1 to December 31, 1949)	96
Additions to List of Members	107

VOLUME XV
No. 3 — 1950

32 VICTORIA ST
LONDON, SW1

Annual Subscription to Non-Members - £2.2.0
Price per Number to Non-Members - 5s. 0d.

The I.E.S Council and Committees

Session 1949-1950

Council

President :— J. N. ALDINGTON, B.Sc., Ph.D. (*Fellow*).

Vice-Presidents :— L. J. DAVIES, B.Sc., M.A., C. R. BICKNELL, B.Sc. (*Fellow*), W. R. STEVENS, B.Sc. (*Fellow*).

Members of Council :—

Elected Members:—

A. D. S. ATKINSON, H. S. BARLOW, S. S. BEGGS, B. F. W. BESEMER, H. BRIGHT, H. G. CAMPBELL, W. J. WELLWOOD FERGUSON, G. H. GILES, H. F. GILLBE, C. A. HOSKINS, J. N. HULL, A. W. JERVIS, E. C. LENNOX, J. H. NELSON, L. C. RETTIG, E. B. SAWYER, J. S. SMYTH, W. T. F. SOUTER, J. F. STANLEY, W. S. STILES, D. A. STRACHAN, P. CRAWFORD SUGG, S. G. TURNER, E. WOOD.

Ex-Officio Representatives of Centres:—

W. C. BOWLER (*Bath and Bristol*), P. HARTILL (*Birmingham*), J. S. CHILDS (*Cardiff*), D. H. PURVIS (*Edinburgh*), A. MACGREGOR (*Glasgow*), A. G. SMITH (*Leeds*), F. JAMIESON (*Leicester*), C. C. SMITH (*Liverpool*), F. J. R. MAKIN (*Manchester*), A. J. OGLE (*Newcastle*), R. H. ELLIS (*Nottingham*), H. B. LEIGHTON (*Sheffield*).

Hon. Treasurer :— J. G. HOLMES.

Hon. Secretary :— H. C. WESTON.

Hon. Editor of Transactions :— W. R. STEVENS.

All Past-Presidents of the Society are *ex-officio* Members of Council.

Committees

GENERAL PURPOSES COMMITTEE: J. N. Aldington (*President*), J. G. Holmes (*Hon. Treasurer*), H. C. Weston (*Hon. Secretary*), J. W. T. Walsh, J. M. Waldram (*Past-Presidents*), L. J. Davies, C. R. Bicknell (*Vice-Presidents*), P. Hartill (*Birmingham Centre*), A. J. Ogle (*Newcastle Centre*).

PAPERS COMMITTEE: A. D. S. Atkinson, C. R. Bicknell, J. N. Hull, W. T. F. Souter, W. S. Stiles, P. C. Sugg, J. M. Waldram.

EDUCATION COMMITTEE: R. O. Ackerley, H. S. Barlow, A. Cunnington, W. J. Jones, J. T. MacGregor-Morris, F. C. Smith, W. R. Stevens, J. W. T. Walsh.

I.E.S. CODE COMMITTEE: R. O. Ackerley, J. H. Nelson, E. B. Sawyer, F. C. Smith, J. S. Smyth, W. T. F. Souter, J. F. Stanley, W. S. Stiles, H. C. Weston.

DEVELOPMENT COMMITTEE: R. O. Ackerley, A. D. S. Atkinson, H. G. Campbell, G. H. Giles, C. A. Hoskins, A. W. Jervis, J. T. MacGregor-Morris, L. C. Rettig.

AREAS JOINT COMMITTEE: One representative from each Centre. Council's Representatives: C. R. Bicknell, J. H. Nelson, W. R. Stevens.

(The President, Hon. Secretary and Hon. Treasurer are *ex-officio* members of all committees.)

Secretary :—G. F. COLE, 32, Victoria-street, London, S.W.1.

A Polar Distribution Calculator

By H. V. SHURMER, M.Sc.*

Summary

This paper describes a simple graphical means of calculating the candle-power distribution in a plane perpendicular to the axis of the source(s) of any lighting fitting which employs fluorescent lamps and specular trough reflectors. The method is derived from considerations of the geometrical and optical properties of reflecting systems in conjunction with the lamp. In order to save time and labour in the initial stages of the design of fittings, an instrument has been developed to facilitate the graphical work. All that is necessary for the polar curve to be found is a cross-section drawing to scale of the proposed optical arrangement.

Theory

It is not obvious what distribution a curved reflector will produce when placed behind a lamp, but we are familiar with the effect of situating a plane mirror behind one. When we put an object in front of a plane mirror an image will be formed as far behind the mirror as the object is in front, and will appear equal in size to the object.

Consider as an object for reflection a cylindrical light source mounted vertically. For simplicity it is assumed that the lamp has uniform brightness, B, and that the mirror exhibits purely specular reflection and has the same reflectivity, k, for all angles of incidence. (It will later be seen whether these assumptions lead to calculated results sufficiently close to those obtained by direct measurement.) A cross-section of the arrangement is shown in Fig. 1 (a), S representing the lamp souce and I its image behind the mirror AB, which is also mounted vertically.

Let us observe the change in appearance of the system as we move slowly round from the front to the back of the mirror. We shall be moving in a plane perpendicular to the lamp axis. It is the distribution of light in this plane that interests us in the case of an elongated lamp, since we can do little to modify the shape of the distribution in planes passing through the axis. In the following examination we shall only consider directions which lie in this plane.

At a certain position the image begins to disappear behind the edge of the mirror and later the source becomes cut off from the view by the back of the mirror.

Suppose the mirror is now removed and replaced by a second source, identical with the first, in the position previously occupied by the image, and an opaque, non-reflecting screen represented by AT and BT^1, with a further curved screen to cover the back of the second source is added, as shown in Fig. 1 (b). The new system will appear exactly the same as the previous one for every direction of view and, if the second source is reduced in brightness to a fraction k times the brightness of the first, the new system will have the same light distribution. We will call this the equivalent system to the first.

Fig. 1 (c) shows the equivalent system when the mirror AB has been shortened to AB^1 (shown dotted), so that it now has a width less than the diameter of the source. Obviously, in this case, an observer some distance away would not see the whole of the image for any direction of view. Fig. 1 (d) represents the equivalent system in the ultimate case where the mirror is reduced to so small a size that it may be represented by the point A. The screens lie along the tangents from A to the source.

A useful way of regarding the effect caused by the element of mirror at A is that this element has a brightness kB when it is viewed over the angle tAt^1. Light is

* Manuscript received May 23, 1949, and in revised form September 22, 1949. The author is with the British Thomson-Houston Co., Ltd.

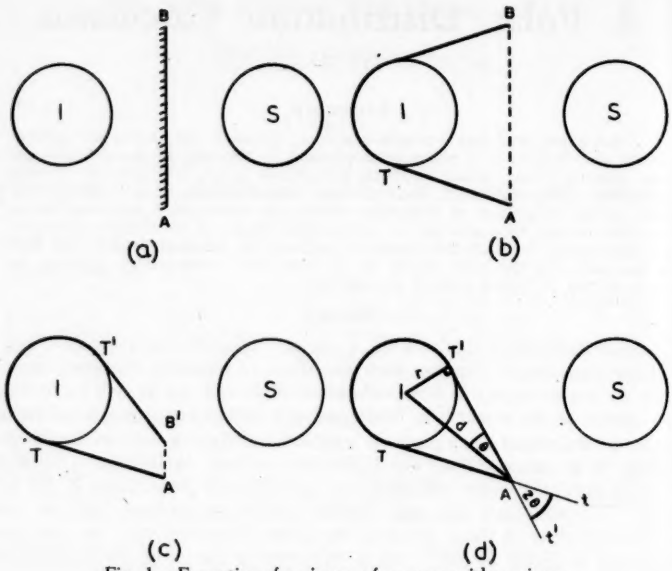

Fig. 1. Formation of an image of a source with a mirror.

reflected at A only over this range of directions. When viewed in other directions the point A appears dark

The angle of spread, tAt^1, depends, for a given source, only on the distance of the source from the point A, and the two are related by the expression :—

$$d = r \operatorname{cosec} \theta \quad \text{.....Equation (1)}$$

where d = distance of centre of source from A.
r = radius of source.
$\theta = \frac{1}{2} t\hat{A}t^1$.

Point A can be anywhere on the mirror. It follows then that every part of the mirror either appears dark or has a brightness kB.

If this statement is true for a plane mirror it also holds for a curved reflector since every small element on the curved reflector must have the same brightness as the small element of plane mirror tangential to it, which is always either kB or zero.

Consider what this means for any arrangement of cylindrical lamp and trough-shaped reflector, as in Fig. 2. Set up the lamp and reflector vertically as with the plane mirror and observe the effect as we again move round to the back of the reflector.

The reflected light from the lamp gives rise to the appearance of a bright strip in the reflector; or there may be more than one bright strip, according to the shape of the trough and the direction of view. The strips are equal in length to the lamp, as

Fig. 2. Cylindrical lamp and trough reflector.

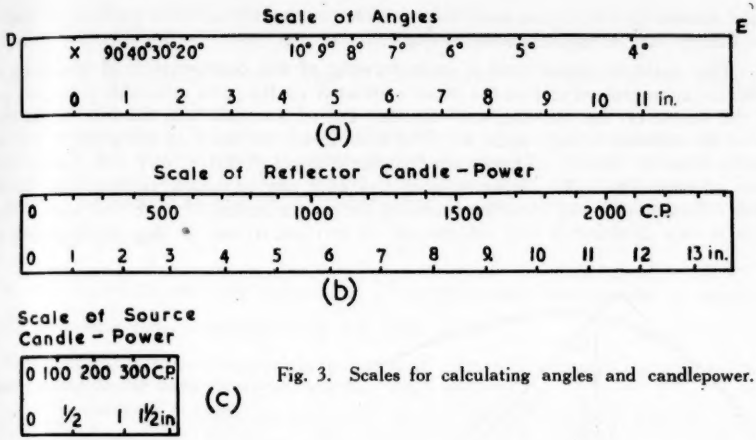
Scale of Angles
D
E
X 90° 40° 30° 20° 10° 9° 8° 7° 6° 5° 4°
0 1 2 3 4 5 6 7 8 9 10 11 in.
(a)
Scale of Reflector Candle-Power
0 500 1000 1500 2000 C.P.
0 1 2 3 4 5 6 7 8 9 10 11 12 13 in.
(b)
Scale of Source Candle-Power
0 100 200 300 C.P.
0 ½ 1 1½ in.
(c)

Fig. 3. Scales for calculating angles and candlepower.

the reflector is not curved along its length but they vary in width according to the direction of view. From the above considerations the brightness of these strips must be uniform and equal to kB while the remainder of the reflector appears dark.

The contribution of the reflector to the candle-power in any direction must come from the bright strips and be proportional to their aggregate width. If we can draw a line by some geometrical construction on the drawing of a cross-section of the arrangement equal to the width of each bright strip in any direction we then have a means of predicting the candle-power distribution.

From equation (1) can be found the angle 2θ over which any point reflects light if the distance of the point from the centre of the source is known. If we draw a

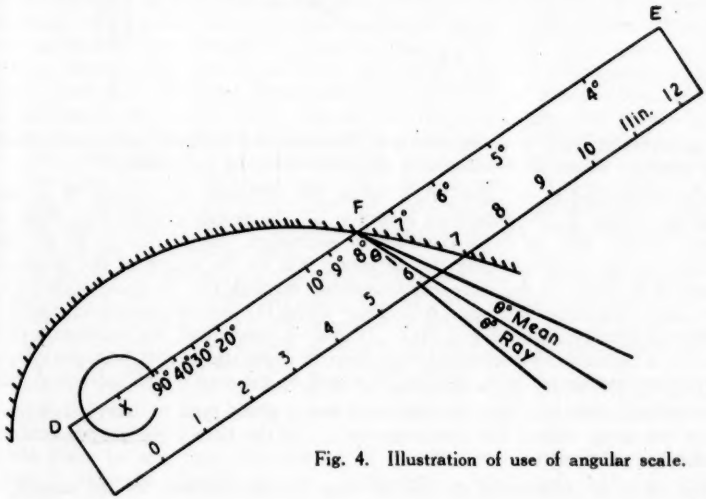

Fig. 4. Illustration of use of angular scale.

scale, shown in Fig. 3 (a), such that d inches along the scale is marked θ deg. we can find θ very simply as shown in Fig 4.

This scale is placed over a scale-drawing of the cross-section of the lamp and reflector arrangement so that the point marked X on the scale coincides with the centre of the source on the drawing, and the edge DE of the scale cuts the line which represents the reflector at any point F. The reading on the scale at the point F will then be the value of θ at F. This means that the element of mirror at F will appear bright over an angle 2θ. The mean reflected ray at F can be drawn, representing the path after reflection of a ray from the centre of the source striking F. F will appear bright from a view direction θ deg. on one side of this line to one θ deg. on the other side.

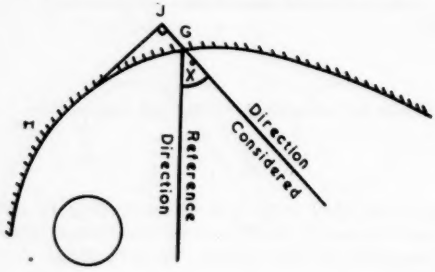

Fig. 5. Construction giving reflector candlepower in one direction.

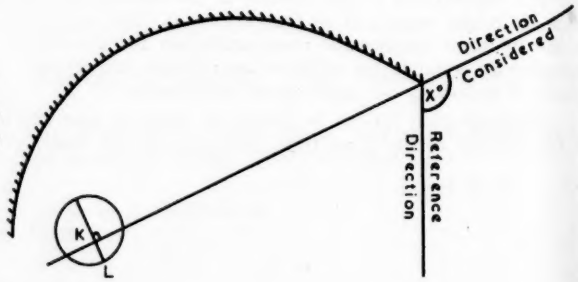

Fig. 6. Construction giving lamp candlepower near cut-off.

Thus, in terms of angle to some reference direction, the extreme limits over which light can be seen are noted for a succession of points all along the reflector.

If it is required to find the effect when the reflector is viewed in a direction inclined at x deg. to the reference direction all the points contributing light can be selected. These will lie in a continuous succession, say, from G to H (Fig. 5). The width of the bright strip in this direction will be the length of the perpendicular HJ from H to a line in the considered direction through G. A linear scale of candlepower can be drawn so that when it is placed along HJ the corresponding candle-power can be read directly. (See Fig. 3 (b).) If there is more than one succession of bright points for a particular direction of view then the operation must be repeated and the total reflected candle-power in this direction will be the sum of the individual values.

To obtain the calibration of this scale for a given type of lamp, it is necessary to know the lamp radius, the candle-power C_s of the bare lamp perpendicular to its axis, and the value of k.

This value is represented on the drawing by the diameter of the source, which

is 2r inches. We have already seen that the bright strips of the reflector have a brightness kC_s. Therefore one inch on the candle-power scale to be applied to HJ represents $\frac{kC_s}{2r}$ candle-power. This is the required calibration of the scale of candle-power for the reflector.

Fig. 6 represents a direction of view in which the only light is coming from the lower part of the source, which is partly hidden by the edge of the reflector. The candle-power is proportional to KL, the depth of source visible in this direction. For the source, 2r inches represents C_s candle-power, and therefore KL represents $\frac{KL.C_s}{2r}$ candle-power.

A scale in which one inch represents $\frac{C_s}{2r}$ candle-power can be used to read off directly the candle-power represented by KL. (Fig. 3 (c)).

Three scales, each marked out along a straight edge, are therefore required for the determination of the complete polar curve. They are:—

(1) *Scale of Angles,* such that a point d inches along the scale is marked off as θ deg., where $d = r \operatorname{cosec} \theta$. (Fig. 3 (a)).

(2) *Scale of Reflector Candle-power,* such that a point n inches along the scale is marked as $n_x \frac{kC_s}{2r}$ candle-power. (Fig. 3 (b)).

(3) *Scale of Source Candle-power,* such that a point m inches along the scale is marked as $m_x \frac{C_s}{2r}$ candle-power. (Fig. 3 (c)).

It will be apparent that different scales are required for each change in source diameter or intensity, or in the reflection factor of the reflector.

Procedure

On the drawing of the light source and reflection arrangement, the reflector is divided into as many points as is convenient, approximately evenly spaced. The point marked X on the Scale of Angles is placed at the centre of the light source, and the straight-edge rotated about this point until it joins it up with one of the points at which the reflector has been divided. This point will lie against a certain value of angle (θ deg.) marked on the scale. This angle is half the total angle over which light is reflected at the point considered, and is noted. The line is drawn which represents the path after reflection of a ray which arrives at the point from the centre of the source. The angle between this line and a reference direction is measured. Let this angle be x deg. Each point will then reflect light between the directions at $(x - \theta)$ deg. and $(x + \theta)$ deg. to the reference direction. These limits are found for each point, and it is convenient to tabulate them.

To find the candle-power in a chosen direction the two extreme points, or pairs of extreme points, which contribute light in this direction are selected from the tabulated angles mentioned above, interpolating as necessary. For each pair of such points a line is drawn in the chosen direction through one of the points and the perpendicular is dropped on to it from the other point.

The sum of the readings on the Scale of Reflector Candle-power corresponding to the lengths of these perpendiculars is the candle-power due to the reflector in the direction considered.

Should there be any light reflected so as to strike the source again experiment shows that it must be considered lost. Allowance is best made for this light as

shown in Fig. 7. Suppose the points between M and N are all reflecting light in a certain direction. NO is a line through N in this direction, and PQ is the diameter of the source lying perpendicular to this line. QU is a line through Q parallel to NO, and cuts the perpendicular MV from M to NO at U. If the candle-power corresponding to MU instead of the value corresponding to MV is read off the Scale of Reflector Candle-power, this is the corrected value which allows for the light lost by being reflected back on to the source.

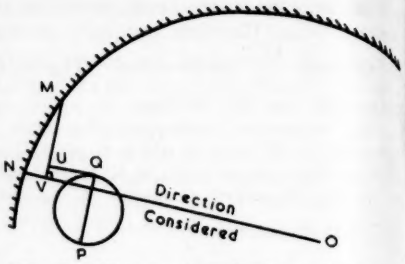

Fig. 7. Allowance for reflections onto source.

If the complete source is visible in the chosen direction, then the total value of candle-power of the fitting in this direction will be the value due to the reflector plus C_s candle-power. If the source is partially hidden in the chosen direction it will contribute a smaller value than C candle-power. To find this reduced value a line is drawn in the chosen direction to pass through the edge of the reflector, and to cut the diameter of the source perpendicular to this line at K (Fig. 6). The reading on the scale of source candle-power corresponding to KL is the candle-power due to the source in the direction considered. If there is any part of the reflector visible and reflecting light in this direction, the candle-power due to the reflector should be found and added to that made by the source.

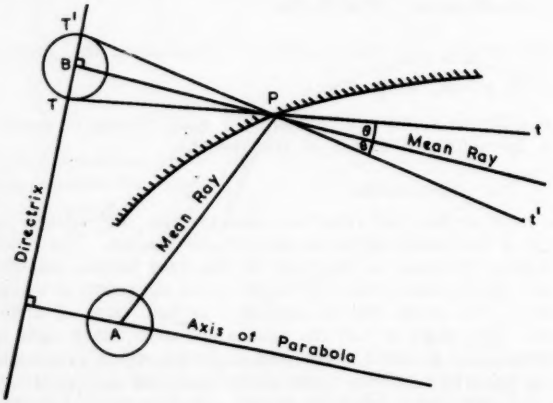

Fig. 8. Simplified case using a parabolic reflector.

If there is more than one source or more than one reflector in the fitting the total candle-power in any direction is the sum of the contributions made by the sources and reflectors. These can be found separately as described above.

Parabolic Reflectors

With the lamp situated at the focus, the centre of the image formed by any small element of a parabolic reflector will lie on the directrix. This fact makes it possible to simplify considerably the procedure for calculating the polar curve in such cases.

Consider a small element of reflector at any point P (Fig. 8). B is the centre

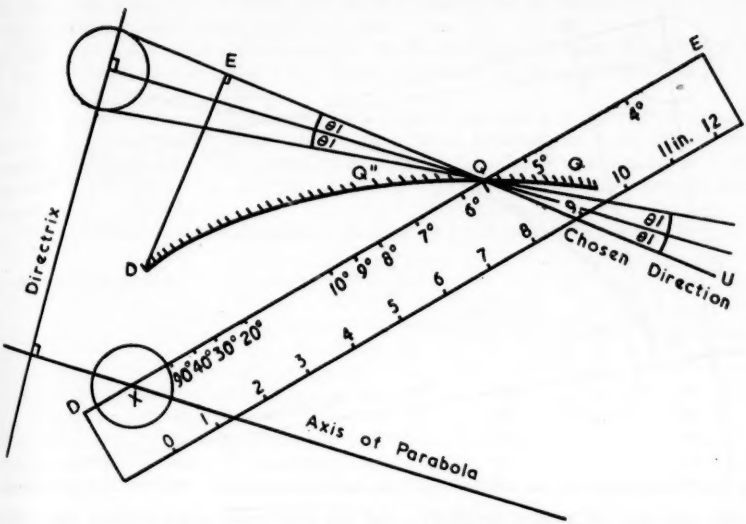

Fig. 9. Use of angular scale with parabolic reflector.

of the image formed by P. The angle tPt^1 (2θ deg.) covers the range of directions over which P appears bright. If the Scale of Reflector Candle-power is applied to AP it will give the angle θ deg.

The mean ray at P is BP produced, this line being parallel to the axis. The mean ray at every point on the reflector will lie in this direction, which it is, therefore, convenient to take as the reference direction.

To find from such an arrangement the candle-power in any chosen direction, inclined at say θ_1 deg. to the axis, we procede as follows:—

The Scale of Angles is placed over the drawing with the point X on the scale at the centre of the source. The straight-edge is rotated about this point until it cuts the reflector at the point on the scale marked θ_1 deg. Let this point be Q. (Fig. 9.) QU, inclined at θ_1 deg. to the axis, will be the direction we have chosen. No light will be reflected from Q in any direction inclined to the axis at an angle greater than θ_1 deg.

For any point such as Q^1, which is further away from the centre of the source, the value of θ will be less than θ_1. Therefore no point farther away from the source than Q^1 will reflect light in the chosen direction. Conversely, for any point such as Q^{11}, which is nearer to the centre of the source, the value of θ will be greater than θ_1. Therefore all points nearer to the source than Q will reflect light in the chosen direction.

If D is the edge of the reflector nearest to the source, the perpendicular DE is drawn from D to cut QU produced. The value of candle-power on the Scale of Reflector Candle-power which corresponds to DE is the contribution made by the reflector in the direction inclined at θ_1 deg. to the axis. If the edge of the reflector is at D^1 (Fig. 10) such that the tangent FG to the source in the direction at θ_1 deg. cuts DE at F, a candle-power corresponding to D^{1}F is lost in this direction owing to the obstruction of the source. The corrected candle-power is the value corresponding to FE on the Scale of Reflector Candle-power.

For a parabolic reflector which extends on to both sides of the axis the parts

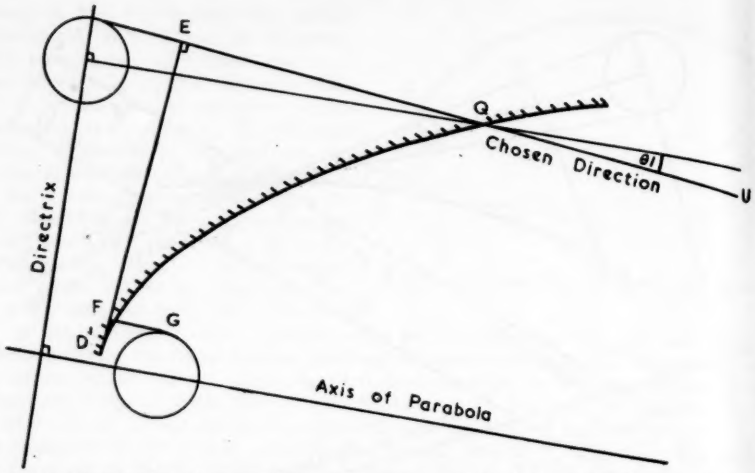

Fig. 10. Construction giving candlepower from source and parabolic reflector in one direction.

on each side may be treated separately, and the total candle-power from the reflector in any direction will be the sum of the candle-powers produced by each part.

For small values of θ the operation involving the Scale of Angles cannot be done, as a finite value of θ corresponds to the far edge of the reflector. For all values of θ less than this the complete area of the reflector appears bright.

The contribution made by the reflector is found as previously described.

Polar Distribution Calculator

The three scales which have been described may conveniently be set out along the edges of a 30-deg. set-square, as shown in Fig. 11. The Scale of Angles is set

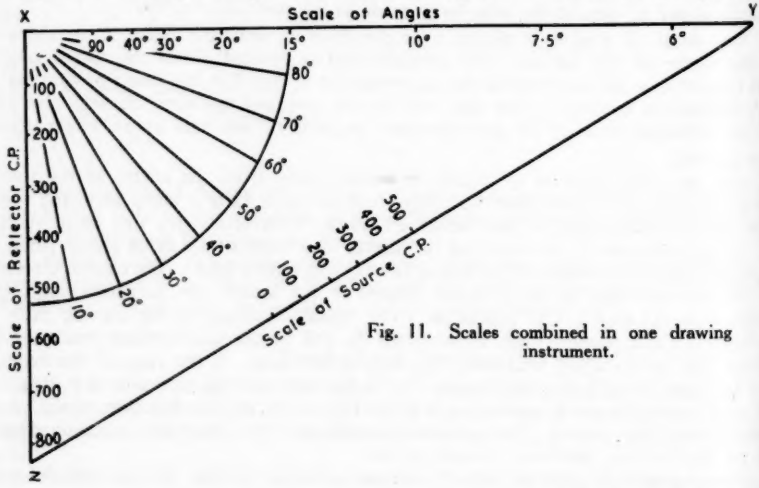

Fig. 11. Scales combined in one drawing instrument.

out along the edge XY, X being the point to be placed at the centre of the source when making a measurement with this scale.

The Scale of Reflector Candle-power is set out along the edge XZ, and the Scale of Source Candle-power along YZ. There is no need for the latter scale to be longer than the diameter of the source.

It is found useful to draw radial lines from X, so that it is not necessary to use a separate protractor in the constructions. It is never necessary to draw any of the perpendiculars which have been mentioned, since if the edge XY is placed in a chosen direction the edge XZ lies at right angles to this, and the candle-power is read off immediately along XZ.

Table I shows typical values of k obtained on a specular reflectometer for a variety

Table 1.

Reflector Material	Specular Reflectivity (k)	Total Reflectivity
Super purity anodised aluminium	72	88
"E" quality anodised aluminium	65	84
Commercial quality anodised aluminium (A) ...	55	84
Commercial quality anodised aluminium (B) ...	53	78
Silvered glass	83	89

of specular materials which are used. It is found that over a wide range of incidence angles k remains approximately constant and it is the value at 45 deg. incidence, which is approximately equal to the mean value over this range, which is quoted in Table I. This table also gives typical total reflectivities.

Constants

The calibration of the scales for the Polar Distribution Calculator involves a knowledge of the constants C_s, r and k. These will vary according to the type of lamp.

It is customary to base the distribution curves of a lantern on its performance with a new lamp of the rated lumen output, so a value for C_s calculated from the published figures of total light output or brightness of the source is used.

For each particular type of lamp there is a factor n such that n times total light output (in lumens) gives the candle-power normal to the axis of the lamp. Values of n for the 5 ft. 80 watt and 4 ft. 40 watt fluorescent lamps are 0.111 and 0.108 respectively.

If the value of average brightness is available C_s is obtained by multiplying this value by the product of the effective values of length and diameter of the lamp.

Approximations in Applying the Polar Distribution Calculator to Fluorescent Lanterns

The Polar Distribution Calculator will foretell polar curves exactly if the following conditions are satisfied:—

(1) The light sources are cylindrical.
(2) The light sources have uniform brightness.
(3) The reflectors are purely specular.
(4) The coefficient k is constant for all angles of incidence.
(5) There are no double reflections.
(6) The reflectors are made exactly to the profile required.
(7) All light reflected back at the source is lost.

The light sources differ very little from cylinders in the case of fluorescent lamps as the diameters are made to close tolerances.

Although the brightness does vary along the lamp this does not give rise to any

error in applying the Polar Distribution Calculator for the following reason. Take any two points situated a small distance apart along such a lamp and consider the section of the fitting which lies between them. The ratio of the candle-power in any direction from the section, to the bare lamp candle-power over the same section, will be constant all along the lamp, for the ratio does not depend on the brightness of the lamp. If we divide the fitting into as many sections as there are gradations in brightness along the lamp, the lamp candle-power, C_s, will be the sum of the candle-powers due to each section of the lamp. The candle-power in a particular direction from any section of the fitting will be a constant times the lamp candle-power over that section. Therefore the total candle-power from the fitting in that direction will be a constant times the sum of the candle-powers due to each section of the lamp, i.e., the same constant times C_s, no matter what the variation in brightness along the lamp.

The brightness across the lamp is substantially constant, diminishing gradually towards the edges. Some error must, however, be expected from this transverse variation. Although the assumption of constant transverse brightness is not strictly true, there is an "averaging effect" from different parts of the reflectors. This does not help, however, in giving a more accurate calculation when the lamp is partially hidden. In this case, when half or the whole lamp is visible the error is zero, so that the error introduced here is not likely to be a large percentage. In any case, without the assumption of uniform brightness such a simple method of calculating polar distribution would not be possible.

The specular reflectivity of the material may be considerably less than its total reflectivity. This is so with most grades of anodised aluminium, which is the material commonly used in fittings of the type with which we are concerned. This fact does not mean that a substantial error is necessarily involved in using for k a particular constant which may be taken as the mean specular reflectivity, since the diffuse component with these materials is spread over a large angle and its component in any particular direction is very small. It should, however, tend to result in values of measured candle-power slightly higher than those obtained by calculation.

Although k is not strictly a constant for varying angles of incidence it has a value which for the reflector materials in which we are interested does not vary by more

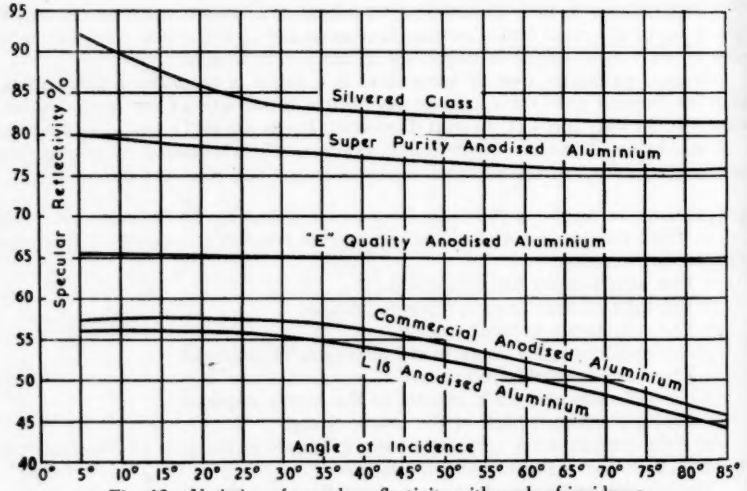

Fig. 12. Variation of specular reflectivity with angle of incidence.

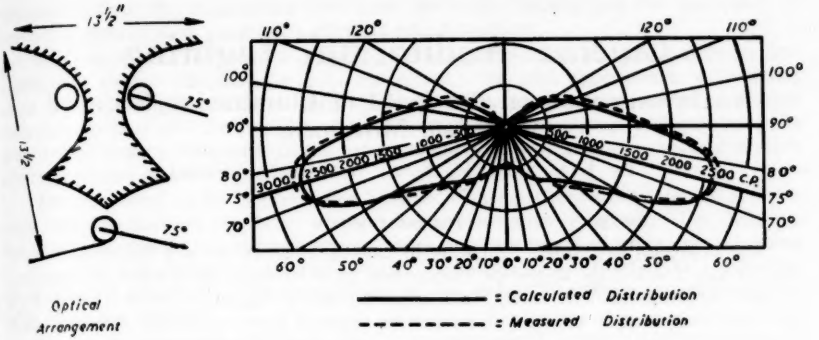

Fig. 13. Comparison of calculated and measured candlepower curves.

than a few per cent. over the greater range of incidence angles, as shown in the curves of Fig. 12. With aluminium the reflectivity is almost constant over the range shown, although it decreases towards high angles of incidence in the poorer grades, due to irregularities produced on the surface by the anodising process. In practice we are concerned with an even smaller variation in k than the curves of Fig. 12 suggest. At angles of incidence which approach zero the light is reflected back at the source and is considered lost, while large angles of incidence are rarely encountered, for the reflector would be used most uneconomically if this were so. Therefore, only the slight variation in specular reflectivity over a limited range of incidence angles is of any consequence. Further, since the contribution of the reflector to the candle-power in any direction is from light striking the reflector at widely different angles within this range, the tendency is for variations in the specular reflectivity to cancel out each other.

In most well-designed reflectors double reflections are avoided or minimised for reasons of efficiency and this method neglects any doubly reflected light.

It may at first appear too obvious to say that the reflectors must be shaped exactly to the profile required, but in fact we can never obtain two reflectors exactly alike. They have to be rolled, pressed, or hand formed, and small variations, which are of no consequence in the practical application of the fitting, inevitably arise. Thus a measured polar curve may show some difference from a calculated curve on this score.

It is not strictly true that all light which strikes the reflector so as to be re-directed at the source is lost. Experiment has shown that the light will produce some increase—in the brightness of the lamp, but such a small increase (a maximum of 5 per cent.) as to be negligible in the calculations.

Experimental Agreement

The foregoing considerations suggest that the Polar Distribution Calculator may provide a reasonably accurate means of foretelling distributions. Practice does confirm that this is so. Fig. 13 shows the optical arrangement of a three-lamp lantern and the excellent agreement which is obtained in the measured and calculated distributions.

Acknowledgment

The author wishes to thank Mr. L. J. Davies, Director of Research of the B.T.H. Co., Ltd., for permission to publish this paper.

J. S. SMYTH

Cinema Auditorium Lighting

An Investigation on the Level of Illumination Required for Safe Movement

By J. S. SMYTH, B.Sc., A.M.I.E.E. *(Fellow)*.

Introduction

The provision of "safety" lighting in cinema auditoriums is a statutory requirement in this country; the degree of illumination must be sufficient to allow the audience to leave the auditorium in safety, and, since the safety lighting is most needed if the usual electricity supply should fail, it must be supplied from a separate source, usually a secondary battery. This safety lighting is kept alight throughout the performance

In addition, most authorities call for a higher level of lighting during the showing of a film, intended to ease movement in the aisles and among the seats, and to preserve order and good behaviour. This is known as the "maintained" lighting; and the degree of illumination desirable has been fully investigated (1). The bulk of the maintained lighting may thus be provided from the normal lighting circuit, but a proportion, constituting the "safety" lighting, must be independent.

A British Standards Committee CME/4/5 was set up in 1948 to study and recommend standards for auditorium lighting; it appeared that, although the question of maintained lighting was well documented, it was not possible to state the minimum value for the safety lighting—which can be considerably dimmer than the maintained lighting, if the latter is designed to allow patrons to reach their seats without the use of hand torches.

A technical panel (2) was therefore set up to study safety lighting; the first part of its investigations are described here since it is thought that the results so far obtained and the method of making the experiments will be of interest.

Conditions Assumed in the Auditorium

When planning the initial experiments it was necessary to make certain simplifying assumptions if the tests were to be manageable.

First, it was agreed not to take into account those members of the audience who might have just entered the theatre, and might thus be adapted to a high brightness level. It was considered that these people could form only a small proportion of the audience, and would have dark-adapted to some extent in the foyer. The critical condition was taken to be after a sudden extinction of all sources of light except the safety lighting; the audience would then be adapted to the screen brightness (taking the hard case of those seated at the front of the auditorium).

The second assumption was that the safety lighting was reasonably uniform. This is by no means so in many cinemas, but great diversity in illumination introduces so many variable factors that its investigation was deferred until information on the desirable uniform illumination had been obtained.

With a relatively high level of safety lighting, an audience will be able to see well enough for safe movement immediately after extinction of all other sources of light; as the level of safety lighting is reduced, an increasing period of dark adaptation will be required. The permissible interval (if any) after extinction of the lighting can only be decided on general grounds: the information required from the tests was the

Communication from the Staff of the Research Laboratories of The General Electric Company, Limited, Wembley, England.

relation between the illumination level from the safety lighting and the time taken to reach that state of dark adaptation allowing safe movement.

The criterion of visibility was agreed as the discernment of seats, gangways and exists to a degree adequate for safe movement. No trial experiments were made, since it was thought that each individual should decide his own criterion without reference to that of others. The observers, with one exception, were not specially practised in making judgments of the nature required, except insofar as such conditions are encountered in everyday life.

The tests were made in the Tatler Theatre, Charing Cross-road, and all observations were restricted to the stalls, which could be conveniently lighted. The illumination was provided by an indirect system, from a fitting mounted on a column about 10 ft. high in the middle of the auditorium. The lamp in this fitting was surrounded by a reflector which directed the light on to the walls and ceiling and screened the lamp from the observers.

The relation between voltage on the lamp and its light output was known, and by means of a single reading of illumination in the theatre at a known voltage, it was possible to deduce the illumination for any other voltage.

Measurements of uniformity of illumination on a horizontal plane 3 ft. from floor level were made before the tests began : the diversity of illumination over the test area (30 ft. by 40 ft.) was about 2 : 1, which is effectively uniform.

Care was taken to exclude all stray light and exit box signs were extinguished.

The brightness of the screen, with shutter running but with no film in the gate, was approx 13 e.f.c.

The following test procedure was adopted :—

One individual, the "controller" of the experiment, was responsible for all of test. He did not make observations.

The observers were first adapted to a standard field brightness by viewing for three minutes the screen on to which a film selected for high brightness was projected. Meanwhile the "controller" had set up the auditorium lighting to an illumination level unknown to the observers. The film was then cut off, and the controller announced five second intervals, so that each observer could note mentally the interval before he considered that he could see his surroundings adequately. The intervals were entered by each observer on a personal record sheet during the next period of screen illumination. By this method, in which each observer recorded his own times without reference to or knowledge of those of others, it was possible to avoid unintentional bias.

This procedure was repeated at a number of different illumination levels, their magnitude being unknown to the observers.

Results of Tests

In all, observations by seven observers were made at seven levels of illumination, and at four of these levels repeat observations were made. The levels were set up in a random order. Table I gives the observed times.

From Table I, it will be seen that observer F gave results suggesting that he could see immediately even at levels where all other observers required more than a minute. His results have therefore been ignored.

The first run at 0.0015 lm/ft.^{2} called for adaptation times considerably greater than the second; the first run at this level was made early in the series, and this difference suggests that observers had not settled down to a steady criterion. The difference does not appear between the first and second runs at the other levels, and in general the repeats are surprisingly close for the kind of judgment involved.

Experience suggests that with such results the average values would be considered satisfactory by all the observers.

Fig. 1 shows the observations for each observer (average of two runs when two

were made), from which it will be seen that the spread is small enough for reliable conclusions to be drawn.

Table I.

Adaptation time in secs. for safe movement after screen black out.

Observer	Average Auditorium Illum.—lm/ft.²										
	.015	.006	.0025		.0015		.0006		.00025		.00015
			1.	2.	1.	2.	1.	2.	1.	2.	
A	0	0	0	5	10	5	75	15	60	65	>5 mins.
B	0	0	5	0	15	5	30	25	60	60	4 mins.
C	0	0	5	7	20	7	60	35	60	90	>6 mins.
D	0	0	5	10	30	5	25	40	95	65	2m. 45 sec.
E	0	0	0	0	20	5	6	15	55	50	4 mins.
F	0	0	0	0	0	0	0	0	0	0	60 secs.
G	0	0	0	0	20	5	40	40	70	70	6 mins.
Average			3		12		34		65		>3 mins.

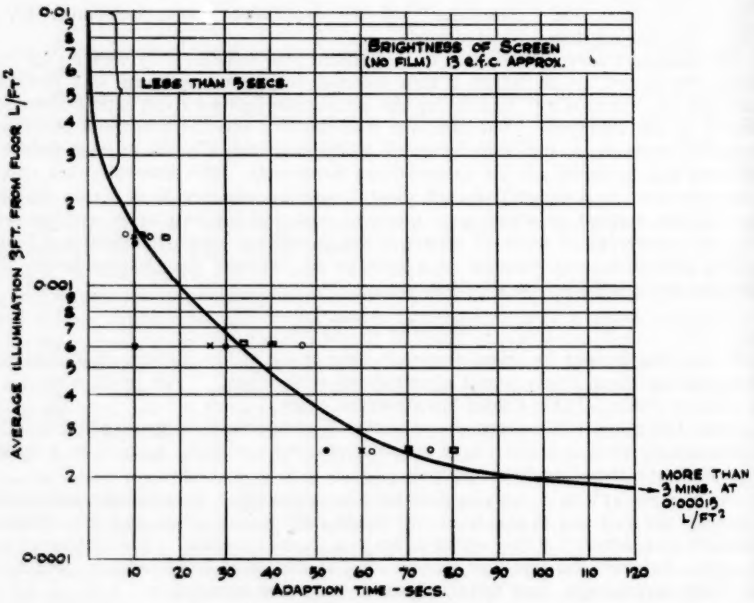

Fig. 1. Results of tests carried out at the Tatler Theatre showing relationship between auditorium illumination and adaptation time for safe movement.

Conclusions

From the relationship of Fig. 1, the adaptation time before safe movement was considered possible may be read off for any level of safety lighting. For example if the permissible time be taken as 5 secs. an average of 0.0025 lumens/ft.^{2} is seen to be adequate—though a higher level should probably be taken to give a factor of safety.

Further Investigation

The conclusions given above were obtained from an installation with indirect lighting and virtually uniform illumination. There appears to be no reason why the results should not be of wider application, provided :

(a) Glare is not introduced by unshaded fittings, and

(b) The illumination is reasonably uniform.

With these provisos, the results should be applicable whether the light is provided by direct or by indirect means. The nature of the gangways walls however is probably very important, since light coloured areas on them will be valuable both as guide marks and for indicating the presence of other persons by silhouette.

The effect of lack of uniformity in illumination may have to be investigated, since many theatres exist where patchiness occurs, but in new installations there should be no difficulty in getting adequate uniformity. For example in the Tatler Theatre, a single 200 watt lamp, whose light was reflected from walls of reflectivity estimated to be at most 20 per cent., gave an illumination at rated volts of approximately 0.1 lumens/sq. ft., many times that required, with a diversity of only 2 : 1.

References

(1) The lighting of Cinema Auditoriums for Visibility and Safety. Weston and Stroud. Trans. Illum. Eng. Soc. (London) IV. No. 3., p. 21, March, 1939.

(2) Constitution of the Panel (including co-opted members): Mr. S. Hart (chairman), Mr. G. E. Fielding, Dr. L. Knopp, Mr. S. B. Swingler, Mr. J. S. Smyth, Mr. A. F. Steel, Mr. H. Lambert.

Notice of Annual General Meeting

The annual general meeting of the Illuminating Engineering Society will be held at the Playhouse Theatre, Buxton, at 2.30 p.m. on Thursday, May 18, 1950, when the report of the Council and the accounts for the past year will be submitted and the usual resolution will be moved appointing auditors for the forthcoming year.

Register of Lighting Engineers

The Council have accepted the following applications for inclusion on the Register of Lighting Engineers:—

S. Anderson, W. C. G. Bailey, B. C. Fleuret, H. B. Mellor, B. C. Ossitt, E. Scott Purdie, C. B. Styles, A. R. Temple, M. C. Toner, H. J. Slater, P. S. Barton.

Report of the Council*

(January 1 to December 31, 1949)

In accordance with established practice the Council present their Annual Report on the affairs of the Society. This Report deals with the forty-first year of the Society, and so with the twelve months ended December 31, 1949. The Council feel that the year has been an encouraging one in every respect; it has been marked by a further increase in membership and income, as well as in the attendance of members and visitors at Sessional Meetings and in the volume of the Society's published transactions.

Officers, Council and Standing Committees for Session 1949-50

In conformity with the procedure laid down in the Articles and By-Laws of the Society, nominations made by the Council to fill vacancies for the Session 1949-50 were circulated to Corporate Members who were given an opportunity to make additional nominations. One additional nomination for ordinary member of Council was received, thereby necessitating a postal ballot the result of which is given below.

During the time between the notification to members of the Council's nominations and the Annual General Meeting in May, when the elections are confirmed, the Council learned to their regret that Mr. J. S. Preston who had been nominated as President would be unable to serve in that capacity. In reporting this at the Annual General Meeting it was pointed out that, there being no precise procedure laid down in these unprecedented circumstances, the Council therefore recommended that Dr. J. N. Aldington be appointed President and that the casual vacancy thereby caused amongst the Vice-Presidents be filled by Mr. W. R. Stevens. This procedure was formally endorsed by the meeting.

Those elected to fill the vacancies of Officers and Members of Council for the Session 1949-50 were therefore as follows:—

President: Dr. J. N. Aldington.
Vice-Presidents: Mr. L. J. Davies, Mr. C. R. Bicknell, Mr. W. R. Stevens.
Hon. Treasurer: Mr. J. G. Holmes.
Hon. Secretary: Mr. H. C. Weston.
Hon. Editor of the Transactions: Mr. W. R. Stevens.
Ordinary Members of Council: Mr. H. G. Campbell, Dr. W. J. Wellwood Ferguson, Mr. C. A. Hoskins, Mr. J. N. Hull, Mr. A. W. Jervis, Mr. E. B. Sawyer, Dr. W. S. Stiles, Mr. D. A. Strachan.

At the first Council meeting in October steps were taken to fill three casual vacancies, each for a period of one year, which had occurred amongst ordinary members of Council by the appointment of Mr. C. R. Bicknell to Vice-President, by the retirement of Mr. H. A. Lingard, and by the resignation from Council of Mr. S. D. Lay who had taken up an appointment in Australia. Acting in accordance with Article 50, the Council appointed the following to fill these three vacancies for the session 1949-50:—

Mr. S. S. Beggs, Mr. B. F. W. Besemer, Mr. E. Wood.

The following were appointed to represent their respective Centres on the Council for the Session 1949-50:—

Bath and Bristol: Mr. W. C. Bowler; *Birmingham*: Mr. P. Hartill; *Cardiff*: Mr. J. S. Childs; *Edinburgh*: Mr. D. H. Purvis; *Glasgow*:

* To be presented at the annual general meeting of the Society to take place at the Playhouse Theatre, Buxton, at 2.30 p.m., on Thursday, May 18, 1950.

Mr. A. Macgregor; *Gloucester and Cheltenham*: Mr. A. G. Holtham; *Leeds*: Mr. A. G. Smith; *Leicester*: Mr. F. Jamieson; *Liverpool*: Mr. C. C. Smith; *Manchester*: Mr. F. J. R. Makin; *Newcastle*: Mr. A. J. Ogle; *Nottingham*: Mr. R. H. Ellis; *Sheffield*: Mr. H. B. Leighton.

The attendance of ordinary members of the Council and representatives of Centres at Council Meetings during the year is given in the accompanying table. Unfortunately, a prolonged illness has prevented the attendance of Mr. W. R. Stevens since his election as Vice-President, and the Council earnestly hope for his complete recovery very soon.

Attendance at Council Meetings

(a) NOMINATED MEMBERS OF COUNCIL

Name	Possible attend.	Actual attend.	Name	Possible attend.	Actual attend.
A. D. S. Atkinson	8	5	S. D. Lay	5	3
H. S. Barlow	8	2	H. A. Lingard	5	0
H. Bright	8	2	A. J. P. Pashler	5	0
G. H. Giles	8	3	A. G. Penny	5	4
H. F. Gillbe	8	3	F. Walker	5	0
E. C. Lennox	8	2	H. G. Campbell	3	3
J. H. Nelson	8	2	W. J. Wellwood Ferguson	3	2
L. C. Rettig	8	5	C. A. Hoskins	3	3
J. S. Smyth	8	6	J. N. Hull	3	2
W. T. F. Souter	8	4	A. W. Jervis	3	3
J. F. Stanley	8	3	E. B. Sawyer	3	2
P. Crawford Sugg	8	3	W. S. Stiles	3	2
S. G. Turner	8	3	D. A. Strachan	3	2
C. J. Allderidge	5	1	S. S. Beggs	2	2
C. E. Greenslade	5	4	B. F. W. Besemer	2	2
T. S. Jones	5	1	E. Wood	2	2

(b) REPRESENTATIVES OF CENTRES

Centre	Possible attend.	Actual attend.	Centre	Possible attend.	Actual attend.
Bath and Bristol	8	6	Leeds	8	3
Birmingham	8	8	Leicester	8	6
Cardiff	8	1	Liverpool	8	4
Edinburgh	8	0	Manchester	8	4
Glasgow	8	2	Newcastle	8	2
Gloucester and Cheltenham	8	0	Nottingham	8	0
			Sheffield	8	8

The Standing Committees as from October, 1949, were constituted as follows:—

Committees

GENERAL PURPOSES COMMITTEE: J. N. Aldington (*President*); J. G. Holmes (*Hon. Treasurer*); H. C. Weston (*Hon. Secretary*); J. W. T. Walsh, J. M. Waldram (*Past-Presidents*); L. J. Davies, C. R. Bicknell (*Vice-Presidents*); P. Hartill (*Birmingham Centre*); A. J. Ogle (*Newcastle Centre*).

PAPERS COMMITTEE: A. D. S. Atkinson, C. R. Bicknell, J. N. Hull, W. T. F. Souter, W. S. Stiles, P. C. Sugg, J. M. Waldram.

EDUCATION COMMITTEE: R. O. Ackerley, H. S. Barlow, S. S. Beggs, A. Cunnington, W. J. Jones, J. T. MacGregor-Morris, F. C. Smith, W. R. Stevens, J. W. T. Walsh.

I.E.S. CODE COMMITTEE: R. O. Ackerley, J. H. Nelson, E. B. Sawyer, F. C. Smith, J. S. Smyth, W. T. F. Souter, J. F. Stanley, W. S. Stiles, H. C. Weston.

DEVELOPMENT COMMITTEE: R. O. Ackerley, A. D. S. Atkinson, H. G. Campbell, G. H. Giles, C. A. Hoskins, A. W. Jervis, J. T. MacGregor-Morris, L. C. Rettig. *Co-opted Members*: H. H. Ballin, G. A. Wedge, R. Pulman, L. E. W. Stokes-Roberts, B. F. W. Besemer.

AREAS JOINT COMMITTEE: One representative from each Centre. Council's Representatives: C. R. Bicknell, J. H. Nelson, W. R. Stevens.

The Council wish to record their thanks to members who have given their time and assistance on committee work during the year.

Meetings in London

Eight Sessional Meetings were held in London during the year. Details of these are given in the following table.

DATE	SUBJECT	AUTHOR
January 11th	"Transport Lighting with Fluorescent Lamps."	H. R. Ruff, J. N. Hull and R. V. Mills.
February 8th	"The Lighting of Churches."	L. C. Rettig.
March 8th	"The Colour of Fluorescent Lamps."	W. Harrison.
April 12th	"The Manufacture of Lighting Glass."	J. G. Holmes.
April 12th	"The Manufacture of Metal Parts for Lighting Fittings."	P. Hartill.
May 10th	"Public Lighting in France and in England at the Present Time."	L. Gaymard.
October 11th	Presidential Address. "New Horizons in Illuminating Engineering."	Dr. J. N. Aldington.
November 8th	"Specialised and General Lighting in Hospitals."	M. W. Peirce and D. J. Reed.
December 13th	"The Operation and Maintenance of Fluorescent Lamp Installations."	W. A. R. Stoyle, and G. D. Jones-Thomas.

A noticeable feature of Sessional Meetings during the past year or so has been the greatly increased attendance of both members and visitors.

The London programme also included a number of Informal Meetings and visits. Informal meetings included a discussion on "Lighting in Coal Mines," a discussion on the motion "That Standardisation Impedes Progress," and a "Brains Trust" meeting. Visits were made to the London Palladium to see the theatre lighting, to the Smethwick Glass-Works of Messrs. Chance Bros., and the Wembley Glass-Works of the General Electric Co., Ltd., and to the National Physical Laboratory. The Council would take this opportunity of expressing their gratitude to those members and others who have helped to arrange visits, and to those organisations who have extended their hospitality to the Society both in London and in the Centres and Groups.

Activities of Centres and Groups

In addition to their normal programmes, several Centres arranged special lectures designed to draw attention to the work of the Society. Such lectures have been well attended and have done much to strengthen the Centres by which they have been arranged. Several Centres again arranged special social events at which distinguished visitors have been present.

The majority of Centres received a visit from the President during the year, accompanied on some occasions by the Secretary. As a rule these visits take place towards the end of the Session. During the last half of the 1948-49 Session Mr. J. M. Waldram visited Centres at Birmingham, Glasgow, Edinburgh, Bath and Bristol, Leeds, Sheffield, Liverpool, and Newcastle, as well as Groups at Teeside and Swansea, in

the latter case at the inaugural meeting. During the first part of the 1949-50 Session, the President, Dr. Aldington, visited the Centre at Leicester; other Centres will be visited during the Session.

A number of Centres and Groups have given or have arranged special lectures to schoolchildren either making use of the Society's standard lecture, which was given to several thousands of children during the year, or by arranging lectures with rather more spectacular demonstrations for audiences in large halls. In all cases the local education authorities, for whom the lectures have been given, have expressed their appreciation of the lectures and of the help given by the Society.

Publications

Once again ten issues of the Transactions were made during the year, this being the number which has been found most convenient for several reasons. From the point of view of headquarters administration it is convenient to avoid publication during the two summer months, when the already limited staff is depleted owing to annual holidays. The flow of suitable papers for publication is still not what is desired; though when more approved contributions are available it may still be most convenient to make only ten issues of the Transactions per annum. The publication of ten instead of twelve numbers does not mean, however, that the annual contents of the Transactions are curtailed; in 1949 the Transactions contained 322 pages against 266 in 1948.

In addition to the papers presented at the London Sessional meetings the following contributions were published during the year: "Design of Contact Lights for Aerodrome Runways" by H. J. Turner, "Gas-Filled Discharge Tubes as Light Sources for High Speed Photography" by J. W. Mitchell, "Studies of Lighting and Vision in Schools" by R. G. Hopkinson, and "On Age and Illumination in Relation to Visual Performance" by H. C. Weston.

During the year an improved and revised edition of the I.E.S. Code was published. Improvements included the use of a better paper and a stiff coloured cover, and the illumination charts were printed in colour. The revised Code was well received, several thousand copies having been sold up to the end of the year; also, the current issue appears to have attracted the attention of architects more than earlier editions.

Other publications during the year include a list of members—the first printed list for several years—and the complete Sessional programme of the Society which, for the first time, appeared in the form of a small pocket-book. Close liaison with the Illuminating Engineering Publishing Company was maintained during the year, and "Light and Lighting" was distributed to members each month.

Leon Gaster Memorial Premium

This year the Leon Gaster Memorial Premium, offered for the best paper contributed and published during the Session, was awarded by the Council to Dr. W. E. Harper and Mr. H. P. Walker for their paper entitled, "Acrylic Plastics in Lighting" which was presented at the Society's Summer Meeting in May 1948. As the Summer Meeting papers had not been published at the time papers were judged for the 1948 award, all these papers were held over until 1949.

The Council regret to have to report once again that no applications were made for the Silver Jubilee Commemoration Award. The attention of younger members, for whom it is intended, is again directed to this award, and other members of the Society are asked to give every encouragement to the junior members of their staffs to make application for the award, full details of which may be obtained from the Secretary.

Membership

The additions to membership during the year were as follows:—

Corporate Members	241
Associates and Country Members	5
Students	20
Sustaining Members	9

It is gratifying to note that the steady growth in the membership of the Society continues.

The Council records with regret the deaths of Mr. H. Hepworth Thompson who was President of the Society in 1934, and of Mr. P. J. Waldram, an original member of the Society.

TOTAL MEMBERSHIP (December 31, 1949)

	Fellows	Corporate Members	Country Members	Associates	Students	Total	Sustaining Members
London	92	542	1	9	24	668	39
Centres :—							
Bath & Bristol ...	4	64	—	9	—	77	3
Birmingham ...	12	219	—	4	8	243	24
Cardiff	3	63	—	1	2	69	1
Edinburgh	4	44	—	—	—	48	3
Glasgow	5	67	1	—	1	74	2
Gloucester & Cheltenham ...	—	35	—	—	—	35	—
Leeds	6	103	—	2	6	117	4
Leicester	1	46	—	1	—	48	—
Liverpool	1	112	—	—	1	114	7
Manchester... ...	6	139	—	2	—	147	8
Newcastle	3	94	—	2	1	100	3
Nottingham ...	5	68	—	2	1	76	1
Sheffield	3	62	—	1	2	68	2
Groups :—							
Bradford	1	32	—	1	—	34	—
Exeter	1	30	—	—	—	31	2
Huddersfield ...	1	35	—	1	—	37	—
Stoke-on-Trent ...	—	24	—	—	—	24	—
Sussex	3	24	—	1	—	28	1
Swansea	—	23	—	—	1	24	—
Tees-side	1	26	—	—	—	27	—
Ireland and Overseas ...	14	80	50	2	—	146	4
TOTAL ...	166	1,932	52	38	47	2,235	104

Fellowship

The election of nine members to Fellowship was announced during 1949, the number of Fellows now being 166.

Early in the year the Council considered suggestions, made jointly by the Board of Fellows and the Registration Board, that the qualifications for admission to Fellowship of the Society should be revised. It was recalled that when Fellowship was first introduced it was intended to serve primarily as a distinction to those members who were outstanding in their contributions to the science or practice of lighting and not necessarily as an indication of competence as a professional lighting engineer.

With the introduction of the Registration scheme as the mark of professional ability it was proposed that the conditions for Fellowship should be revised to emphasise that it is a distinction conferred only for exceptional merit. The revised by-law giving the proposed new conditions was put to the membership by means of a postal ballot, with the result that the new conditions for Fellowship were approved and came into operation in June.

The Board of Fellows have continued to discharge their office with the highest sense of the responsibility which devolves upon them, and the Council desires to thank them warmly.

Register of Lighting Engineers

The year under review was the second year of operation of the scheme for the Registration of Lighting Engineers. By the end of the year 194 applications had been received, with results as follows :—

Applicants included on the Register	101
Applications rejected	37
Applications deferred (at December 31)	12
Applications awaiting attention	44
	194

The work involved in giving each application the most careful attention is considerable, both for the Headquarters staff and the Registration Board. It is essential that a high standard should be maintained, and for this reason there has been, and still is, some long delay between the submission of an application and the notification to the applicant of the result. The task of the Registration Board is an onerous one, and the Council take this opportunity of expressing their thanks to the members of the Registration Board for the way in which they have carried out their difficult duties.

Education

During the educational year ending May, 1949, courses for the Intermediate Certificate of the City and Guilds of London Institute were held at technical colleges in London, Birmingham, Cardiff, Manchester, and Liverpool. Courses for the Final examinations were held in London and Glasgow. Fewer students sat for and passed the Intermediate examination, 62 against 98 in the previous year, but rather more students passed the Final examinations, 20 passing Section "A" and 28 passing Section "B," the figures in the previous year being six and 20 respectively.

In October, 1949, courses for the Intermediate examination were arranged in London, Cardiff, Liverpool, Manchester, Glasgow, and Leeds, whilst courses for the Final were available only in London, Leeds, and Glasgow. Attempts to arrange Final courses were made by other Centres, but were postponed owing to the small number of students available, shortage of qualified teaching staff, and the shortage of suitable accommodation at the technical colleges. The Council would, however, express their gratitude to those who have taken such a keen interest in education and who have helped in making arrangements for courses or in taking part in the actual lectures.

During the year the Education Committee have given further consideration to the question of study groups for those wishing to take the Final examinations but for whom no classes or correspondence courses are readily available. As mentioned above, the only courses for the Final examinations are in London, Leeds, and Glasgow, and, as yet, no correspondence course is available. It was thought that local study groups might be formed at those Centres where there were a few members wishing to take the examinations but not enough to justify the local education authority arranging a course at the local technical college. The proposed scheme unfortunately met with

INCOME AND EXPENDITURE ACCOUNT

1948	Dr.	EXPENDITURE.	£ s. d.	£ s. d.
		To Administration Expenses :—		
1,804		Salaries and State Insurance	1,928 10 0	
249		Rent	343 11 6	
41		Lighting and Heating	48 18 10	
54		Telephone...	80 11 6	
376		Printing and Stationery...	584 1 2	
193		Postage	253 1 1	
142		Travelling Expenses	118 1 8	
262		Sundry Office Expenses	299 14 4	
				3,656 10 1
	,,	Sessional and other Meetings in London :—		
25		Hire of Halls	26 3 0	
28		Reporting and Lantern Operating	37 16 0	
115		Refreshments and Entertaining Expenses	111 15 0	
				175 14 0
1,098	,,	Expenditure of Centres and Groups		1,073 8 0
28	,,	Audit Fee		26 5 0
				4,931 17 1
1,173	,,	Cost of Printing Transactions, Reprints, Blocks, etc. ...		1,302 18 11
—	,,	Cost of Printing List of Members		125 0 0
371	,,	Cost of Printing Symposium on Searchlights		— — —
92	,,	Equipment for School Lectures		40 0 0
—	,,	Expenditure on Annual Dinner *less* Sale of Tickets ...		33 13 2
206	,,	Expenditure on Summer Meetings (including 1948 Dinner) *less* Sale of Tickets		— — —
	,,	Illuminating Engineering Publishing Co., Ltd.—		
		Allocation and Share of Subscriptions...	940 14 0	
		Less Contribution towards administration ...	500 0 0	
416				440 14 0
48	,,	Contributions to Kindred Societies		47 15 0
132	,,	Premium on Deferred Annuities		132 6 4
—	,,	Transfer to Leon Gaster Memorial Fund		5 0 0
				7,059 4 6
177	,,	Excess of Income over Expenditure		669 16 11
£7,030				£7,729 1 5

BALANCE SHEET

1948		£ s. d.	£ s. d.
	Capital Account :—		
	Balance at 31st December, 1948	5,397 15 5	
	Add Excess of Income over Expenditure for the year	669 16 11	
5,398			6,067 12 4
1,000	Reserve for Future Office and Administration Expenses ...		1,000 0 0
	Trotter Memorial Fund—		
	Balance at 31st December, 1948	5 15 6	
	Less transferred to Trotter-Paterson Memorial Lecture		
6	Fund	5 15 6	
			— — —
748	Sundry Creditors...		502 1 6
£7,152			£7,569 13 10

FOR THE YEAR ENDED 31st DECEMBER, 1949

1948 £	INCOME.	*Cr.* £ s. d.
6,133	By Subscriptions...	6,483 12 5
704	,, Sales of publications...	980 9 11
28	,, Registration Fees	69 6 0
162	,, Interest on Investments	173 18 7
3	,, Premium on Conversion of Defence Bonds	– – –
—	,, Transfer from Library Fund	21 14 6
£7,030		£7,729 1 5

31st DECEMBER, 1949

1948 £		£ s. d.	£ s. d.
	Investments at cost :—		
	£2,020 14s. 7d. 3½% Registered War Stock... ...	2,059 15 0	
	£ 250 3% Defence Bonds	250 0 0	
	£2,250 2½% Defence Bonds	2,250 0 0	
	£ 750 2½% National War Bonds	750 0 0	
	£1,000 3% Savings Bonds	1,000 0 0	
	£ 500 3% British Transport Guaranteed Stock	488 4 6	
	(*Market Value 31.12.49* £6,519)		
6,298			6,797 19 6
743	Balance at Bankers and Cash in Hand		677 7 8
111	Sundry Debtors		94 6 8
£7,152			£7,569 13 10

RECEIPTS & PAYMENTS ACCOUNTS

LEON GASTER

	£	s.	d
Balance, 1st January, 1949	243	0	4
War Stock Interest	8	1	0
Transfer from General Fund	5	0	0
	£256	1	4

LIBRARY

	£	s.	d.
Balance, 1st January, 1949	21	14	6
	£21	14	6

NATIONAL ILLUMINATION

	£	s.	d.
Balance, 1st January, 1949	307	2	9
War Stock Interest	10	10	0
	£317	12	9

INTERNATIONAL ILLUMINATION

	£	s.	d
Balance, 1st January, 1949	401	10	6
War Stock Interest	10	10	0
Sale of Proceedings	–	–	–
	£412	0	6

TROTTER-PATERSON

	£	s.	d
Transfer from Trotter Memorial Fund	5	15	6
Donations	219	15	0
	£225	10	6

JOHN S. DOW

	£	s.	d.
Legacy bequeathed by the late Mr. John S. Dow	1,948	2	6
War Stock Interest	16	0	9
	£1,964	3	3

Auditors' Report.—We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our Audit. In our opinion proper books of account have been kept by the Company so far as appears from our examination of those books. We have examined the above Balance Sheet and annexed Income and Expenditure Account and Fund Receipts and Payments Accounts which are in agreement with the books of account. In our opinion and to the best of our information and according to the explanations given to us the said accounts give the information required by the Companies Act

FOR THE YEAR ENDED 31st DECEMBER, 1949

MEMORIAL FUND

	£ s. d.	£ s. d.
Premiums paid for 1949/50		10 10 0
Balance, 31st December, 1949 :—		
Cash at Bank	8 18 2	
£230 3½% Registered War Stock at cost	236 13 2	
(*Market Value 31.12.49* £212)		
		245 11 4
		£256 1 4

FUND

	£ s. d.
Transfer to General Fund...	21 14 6
Balance 31st December, 1949	– – –
	£21 14 6

COMMITTEE FUND

	£ s. d.	£ s. d.
Expenses of delegates to Paris Meeting...		– – –
Balance, 31st December, 1949 :—		
Cash at Bank	13 4 3	
£300 3½% Registered War Stock, at cost	304 8 6	
(*Market Value 31.12.49* £277)		317 12 9
		£317 12 9

CONGRESS FUND

	£ s. d.	£ s. d.
Balance, 31st December, 1949 :—		
Cash at Bank	107 12 0	
£300 3½% Registered War Stock, at cost	304 8 6	
(*Market Value 31.12.49* £277)		412 0 6
		£412 0 6

MEMORIAL LECTURE FUND

	£ s. d.
Balance, 31st December, 1949 :—	
Cash at Bank	225 10 6
	£225 10 6

LEGACY FUND

	£ s. d.	£ s. d.
Legal Expenses		18 19 9
Balance, 31st December, 1949 :—		
Cash at Bank	98 18 6	
£916 11s. 1d. 3½% War Stock	876 5 0	
£500 3% Savings Bonds, 1955/65	492 10 0	
£500 3% Savings Bonds, 1960/70	477 10 0	
(*Market Value 31.12.49* £1,824)		1,945 3 6
		£1,964 3 3

1948 in the manner so required and the Balance Sheet gives a true and fair view of the state of the Company's affairs as at 31st December 1949 and the Income and Expenditure Account gives a true and fair view of the surplus for the year ended on that date.

ROBT. J. WARD & CO., *Chartered Accountants*,
ADELPHI TERRACE HOUSE, 3, ROBERT STREET, ADELPHI, W.C.2.

Dated this 2nd Day of February, 1950.

J. G. HOLMES (*Hon. Treasurer*)
H. C. WESTON (*Hon. Secretary*)

little success; the Education Committee, however, are giving further consideration to the possibility of arranging help for such students. In the meantime a series of articles, written specially for students by one of the members of the Committee, is now appearing in "Light and Lighting."

Other Activities

The Society maintains excellent relations with other cognate organisations, and the Council would like to thank those of its members who continue to represent it on committees such as those of the British Standards Institution and the Council for Codes of Practice for Buildings.

At the annual dinner, held in London at the end of the session 1948-49, a number of representatives of other Societies were present as the guests of the Society, the chief guests being Sir Henry Self, Deputy Chairman of the British Electricity Authority, and Col. H. C. Smith, Deputy Chairman of the Gas Council. The Council would also draw attention to the most friendly co-operation which exists between this Society and the Illuminating Engineering Societies of other countries.

During the year preparations were begun for the next summer meeting of the Society, which is to take place at Buxton in May, 1950.

Financial Position

Income and expenditure have both continued to rise during 1949. The sales of reprints and publications showed a welcome increase, particularly the new issue of the I.E.S. Code which proved an unexpectedly fruitful source of income during the year, and the membership subscriptions have risen steadily. Expenditure on administration and printing has risen, due partly to increased costs and partly to increased numbers, and the only special item was the issue of the list of members which was prepared during the summer. The excess of income over expenditure was nearly £670 and an opportunity was taken to invest £500 in 3½ per cent. war stock at a favourable price. It may be noted that the value of the Society's investments is little more than last year, due to the general drop in market values.

The Library Fund has been dormant for several years and has been transferred to the General Account, because there were several purchases, including a new bookcase, which exceeded the balance in this Fund.

Two new Funds are shown in the accounts. The appeal for an endowment of a memorial lecture to Mr. A. P. Trotter and Sir Clifford Paterson was issued during November and over a hundred subscriptions to the Trotter Paterson Memorial Lecture Fund had been received by the end of the year. The John S. Dow Legacy Fund comprises the cash and securities from the generous legacy to the Society in the will of the late Mr. Dow and it is intended that this money should be used for special purposes, outside the normal expenditure of the Society.

Conclusion

As the Society grows, so does the task of administering its affairs. In this task the Headquarters staff, the various committees of the Council, and the officers and committees of Centres and Groups, have co-operated with the diligence, perseverance, and competence which is essential for the vitality of the body corporate. The Council acknowledges with gratitude the services of all these individuals during the year reviewed; the fruits of their efforts are apparent not only in the continued expansion of membership and of Society activities but also in the enhanced prestige of the Society and in a fuller realisation of its objects. It is abundantly clear that the use of good lighting is becoming more general, and there can be no doubt that the activities

and publications of the Society, combined with the work of its ordinary and its sustaining members are largely responsible for this gratifying trend. Nevertheless, for the Society, as for the nation generally, this is no time for complacency, but rather for the consolidation of gains and the maintenance of our efforts to further the utility and raise the status of the Society. The vitality and importance of a society is not to be judged by "peak" events, but by the level at which it lives habitually. The Council feel that the past year has been a satisfactory one in this sense, and they are confident that there is every reason for expecting that there will be no abatement in the vigour of the Society during the ensuing year.

J. N. ALDINGTON (*President*).

H. C. WESTON (*Hon. Secretary*).

Additions to List of Members

The following applicants have been duly elected by the Council to membership in the Society, and their names have been added to the list of members.

CORPORATE MEMBERS:—

Adrian-Jones, L. ..... 21, Peters Drive, LEICESTER.
Allen, J. ..... 91, Grange Road, Bury, LANCS.
Atkinson, W. F. ..... 20, Coleridge Avenue, Low Fell, GATESHEAD, 9.
Barton, M. S. ..... 17, North Cray Road, Sidcup, KENT.
Barratt, S. ..... 300, Ashton New Road, Beswick, MANCHESTER, 11.
Beeley, T. E. ..... 7, Coronation Road, Windle, St. Helens, LANCS.
Bell, F. W. ..... 10, Sandhurst Road, GLOUCESTER.
Bennett, E. C. ..... 59, Epwell Road, BIRMINGHAM, 23.
Benson, J. ..... 17, Pearson Lane, Bradford, YORKS.
Bessant, J. W. ..... 107, Hambalt Road, Clapham, LONDON, S.W.4.
Bird, A. E. ..... 12, Hawthorn Avenue, Birstall, LEICESTER.
Borresen, Johs. E. ..... 8, Vognmagergade, Copenhagen K., DENMARK.
Bottrill, C. B. ..... 65, Westminster Road, Handsworth, BIRMINGHAM.
Brownlie, C. ..... 83, Midland Road, Wellingborough, NORTHANTS.
Burnett, E. J. ..... 228, Abbotsbury Road, Morden, SURREY.
Butler, G. L. ..... 5, Woodkind Hey, Bebington, CHESHIRE.
Carpenter, H. ..... 171, Victoria Road, Thornton, nr. Blackpool, LANCS.
Cassidy, E. ..... James Kilpatrick and Son, Ltd., 58a, North Castle Street, EDINBURGH.
Chappat, J. J. ..... Compagnie des Lampes, 29, Rue de Lisbonne, Paris 8e, FRANCE.
Cheal, R. F. W. ..... 67, Mill Bank, Wellington, SHROPSHIRE.
Colvin, J. ..... 5, Marlborough House, Marlborough Gardens, LONDON, N.20.
Cooper, E. G. ..... 40, Strongbow Road, Eltham, LONDON, S.E.9.
Corbett, B. G. ..... 16, Aston Church Road, Nechells, BIRMINGHAM, 7.
Crossley, R. S. ..... "Greenlea," Liverpool Road, Lydiate, nr. LIVERPOOL.
Davenport, E. F. ..... 113, Quarry Street, Woolton, LIVERPOOL.
Davies, W. B. ..... 17, Wilson Street, CARDIFF.
Dean, W. F. G. ..... "Lyndhurst," Sefton Road, Formby, LANCS.
Deane, R. B. ..... 77, Woodland Drive, Watford, HERTS.
Dellow, T. E. ..... 41, Reid Park Road, Jesmond, NEWCASTLE-ON-TYNE.
Dickinson, A. J. ..... 42, Rowan Crescent, Streatham, LONDON, S.W.16.
Dinenage, S. C. ..... "Newhaven," Forge Lane, Mill Green, Aldridge, Walsall, STAFFS.
Drummond, M. J. ..... 59, Oakshaw Street, Paisley, RENFREWSHIRE.
Dumbrell, G. W. ..... 38, Brampton Road, Hampden Park, Eastbourne, SUSSEX.
Elaref, A. A. ..... 22, Larpent Avenue, Putney, LONDON, S.W.15.
Ferrier, M. V. ..... 47, Cedar Road, Oxhey, Watford, HERTS.
Frame, A. A. G. ..... 9, Bent Road, Hamilton, LANARKS.
Franklin, E. ..... 37, Chattaway Street, Nechells, BIRMINGHAM, 7.
Gale, A. C. ..... c/o The Edison Swan Electric Co., Ltd., 19/23, Sir Thomas Street, LIVERPOOL, 1.

CORPORATE MEMBERS (*continued*):—

George, J. C. ..... "Almora," 68, Castle Street, Bridgend, GLAM.
Gilbert, J. ..... 46, Queens Road, Urmston, MANCHESTER.
Gow, J. S. ..... c/o Revo Electric Co., Ltd., 2, Eldon Square, NEWCASTLE-ON-TYNE, 1.
Gregory, R. H. ..... 16a, Church Street, Bishop's Stortford, HERTS.
Griffiths, D. R. ..... 22, Henconner Crescent, Chapel Allerton, LEEDS, 7.
Grocott, G. H. ..... 10, Brookwood Avenue, Sale, MANCHESTER.
Hamer, H. ..... 16, Pedmore Grove, Gt. Barr, BIRMINGHAM, 22a.
Harrison, J. B. ..... 63, Mayfair Avenue, Ilford, ESSEX.
Heslop, J. P. ..... 19, Pownall Road, Wilmslow, CHESHIRE.
Hewitt, W. K. ..... 68, Leslie Road, St. Helens, LANCS.
Hill, R. H. ..... "Sandleigh Lodge," Sandleigh Road, Leigh-on-Sea, ESSEX.
Illingworth, G. ..... 77, Clifton Road, Southport, LANCS.
Johnson, C. ..... 4, Richmond Road, Worthing, SUSSEX.
Jones, D. A. ..... 46, Gratwicke Road, Tilehurst, Reading, BERKS.
Joslyn, J. B. ..... c/o Mrs. James, 8, Quintin Street, Gabalfa, CARDIFF.
Keighley, W. ..... 106, Broadgate Lane, Horsforth, nr. LEEDS.
Kenyon, J. W. ..... 512, Derby Road, Lenton, NOTTINGHAM.
Lloyd, C. G. ..... 32, Westbourne Road, Birkdale, Southport, LANCS.
Maisonneuve, J. ..... Compagnie des Lampes, 29, Rue de Lisbonne, Paris 8e, FRANCE.
Melton, C. N. ..... 70, Durham Road, Gateshead, Co. DURHAM.
Neill, E. F. ..... 25, Sandpit Lane, St. Albans, HERTS.
North, W. L. ..... 127, Carr Road, Greenford, MIDDX.
Norwood, E. A. ..... 57, Kingswood Road, Brixton Hill, LONDON, S.W.2.
O'Reilly, J. ..... 347, Cherry Lane, LIVERPOOL, 4.
Peall, G. S. H. ..... 20, Queensmead Avenue, East Ewell, SURREY.
Quarmby, A. D. ..... 22, Blacon Point Road, CHESTER.
Raven, L. ..... 45, Newbridge Street, Wolverhampton, STAFFS.
Rayner, S. R. J. ..... 162, Browning Road, Manor Park, LONDON, E.12.
Rich, P. H. ..... 76, Gordon Road, Harborne, BIRMINGHAM, 17.
Ricketts, F. W. ..... "Lanthony," The Grove, CHELTENHAM.
Riley, C. L. ..... 25, Fleet Street, Stepney Lane, Hull, YORKS.
Shaw, R. W. ..... 16a, Whitton Waye, Hounslow, MIDDX
Shires, W. N. ..... 51, Kings Road, Cheadle Hulme, CHESHIRE.
Slater, L. G. ..... 21, Creighton Road, Ealing, LONDON, W.
Starling, J. F. ..... "Redroofe," Greenhill Road, Carlton, NOTTINGHAM.
Stevens, K. G. B. ..... 10, Medina Drive, Tollerton, NOTTS.
Thomson, J. ..... 26, Garfield Street, GLASGOW, E.1.
Thorne, A. ..... "Braemar," Stanley Road, Forest Town, Mansfield, NOTTS.
Thurston, W. G. ..... 60, The Arcade, SINGAPORE.
Tomlinson, J. S. ..... "Keelgarth," Grafton, YORK.
Turner, D. A. ..... 11, Devonshire Promenade, Lenton, NOTTINGHAM.
Vincent, S. J. ..... The Crompton Engineering Co. (Madras), Ltd., 2nd Line Beach, Madras, S. INDIA.
Vass, P. ..... "Threeways," Wetley Rocks, Stoke-on-Trent, STAFFS.
Wainhouse, N. ..... 41a, Petergate, YORK.
Wilkins, D. ..... 9, East Avenue, Kenfig Hill, GLAM.
Williams, J. H. ..... 25, St. Ambrose Grove, Anfield, LIVERPOOL, 4.
Wilmott, L. ..... "Woodside," West Drive, Cleadon, nr. SUNDERLAND.
Woodhouse, J. ..... 31, Barkers Road, SHEFFIELD, 7.
Wright, R. P. ..... 48, Deakin Road, Erdington, BIRMINGHAM, 24.

STUDENT MEMBERS:—

Eddyshaw, J. ..... 230, College Road, Erdington, BIRMINGHAM, 23.
Mara, E. J. ..... 32, Bonnington Square, Vauxhall, LONDON, S.W.8.
Ogden, K. W. ..... 375, Baker Street, Enfield, MIDDX.
Stedman, H. J. ..... 96, Brampton Road, St. Albans, HERTS.

TRANSFERRED TO CORPORATE MEMBERSHIP:—

Algar, P. H. ..... 98, St. George's Square, LONDON, S.W.1.

I.E.S. Regional Committees
Session 1949—1950

Centres:

BATH AND BRISTOL CENTRE.

Chairman: W. C. Bowler. *Vice-Chairman:* H. Weston. *Hon. Treasurer:* R. G. Capell. *Committee:* D. E. Beard, L. Burdes, H. Foster, A. E. Hayward, E. A. Newburn, S. Poole, C. W. Rawlings, L. C. Rettig, I. M. Robertson, C. C. Shackleton, R. E. Tucker. *Hon. Secretary:* R. S. Hazell, 18, New Fosseway Road, Bristol 4.

BIRMINGHAM CENTRE.

Chairman: P. Hartill. *Vice-Chairman:* F. Penson. *Hon. Treasurer:* J. Ashmore. *Committee:* C. J. Allderidge, F. E. Chapman, V. Heydon, A. J. Holland, J. N. Hull, G. Kemp, D. Lewin, H. Long, R. Mackensie, J. H. Nelson, H. Punter, W. H. Randall, G. Satchwell. *Hon. Secretary:* W. J. P. Watson, 91, Brandwood Road, King's Heath, Birmingham 14. *Hon. Asst. Secretary:* W. E. Prendergast.

CARDIFF CENTRE.

Chairman: J. S. Childs. *Vice-Chairman:* D. C. James. *Committee:* W. A. Cooper, A. J. Dalton, A. W. Gibbs, W. E. James, J. S. Liversage, E. N. Lockyer, J. H. Parker, H. W. Rees, W. H. Stone, S. G. Turner. *Hon. Secretary and Treasurer:* N. D. Houston, 54, St. Mary Street, Cardiff. *Hon. Asst. Secretary:* V. G. Wackrow.

EDINBURGH CENTRE.

Chairman: D. H. Purvis. *Vice-Chairman:* C. N. Kemp. *Hon. Treasurer:* H. Stanway. *Committee:* L. R. Brown, J. S. Galbreath, I. W. Hunter, E. W. MacGrain, A. Pratt, C. K. Ross. *Hon. Secretary:* G. E. L. Comrie, 4, Silverknowes Terrace, Edinburgh 4.

GLASGOW CENTRE.

Chairman: A. MacGregor. *Vice-Chairman:* F. Dunnett. *Hon. Treasurer:* J. Welsh. *Committee:* T. Bayliff, J. M. Henshaw, A. Kelso, C. J. King, W. Quinn, D. Ross, A. B. Wright. *Hon. Secretary:* A. M. Rankin, 53, Pitt Street, Glasgow, C.2.

GLOUCESTER AND CHELTENHAM.

Chairman: A. G. Holtam. *Vice-Chairman:* I. R. Morgan. *Hon. Treasurer:* H. V. Sayce. *Committee:* J. Davoile, I. S. Freemantle, A. H. Green, B. C. Mitchell, H. E. Phillips, C. E. Shaw, H. V. Williams. *Hon. Secretary:* F. J. Chappell, 29, Wellington Street, Gloucester.

LEEDS CENTRE.

Chairman: A. G. Smith. *Vice-Chairman:* J. W. Howell. *Hon. Treasurer:* H. Edmondson. *Committee:* S. Addison, J. R. Bardsley, E. Bastow, R. Benson, J. D. Green, R. D. Green, P. G. Harrison, H. W. Lodge, J. Sewell, J. V. Walshaw, E. C. Walton, J. H. Weaver, M. N. Wilson. *Hon. Secretary:* F. Bullock, Templar House, Lady Lane, Leeds 2.

LEICESTER CENTRE.

Chairman: F. Jamieson. *Vice-Chairman:* R. K. L. Davies. *Hon. Treasurer:* E. C. Came. *Committee:* A. Cartwright, T. Coates, W. N. Coulson, E. W. Freeman, C. G. Hickling, P. H. H. Jantzen, R. H. Phillips, G. Stephens. *Hon. Secretary:* B. V. Rowe, 43, Scraptoft Lane, Leicester.

LIVERPOOL CENTRE.

Chairman: C. C. Smith. *Vice-Chairman:* F. G. Copland. *Hon. Treasurer:* W. T. Trace. *Committee:* D. St. C. Barrie, N. Blackman, R. G. Devey, E. M. Duke, T. Jones G,. J. Peat, K. E. Pickard, W. E. Potter, F. W. White, T. D. Woods, O. C. Waygood. *Hon. Secretary:* K. R. Mackley, Inner Temple, 24, Dale Street, Liverpool 2. *Hon. Asst. Secretary:* F. J. Burns.

MANCHESTER CENTRE.

Chairman: F. J. R. Makin. *Vice-Chairman:* W. G. Chilvers. *Hon. Treasurer:* H. Etchells. *Committee:* H. Atherton, F. S. Boucher, E. J. Bull, Mrs. I. H. Hardwich, H. Hewitt, J. Martin, T. Metcalfe, J. H. Morrison, T. L. Robinson, J. Watson, H. C. White, H. Wilcock. *Hon. Secretary:* W. E. Ballard, Fair Rigg, Fairview Road, Timperley, Cheshire. *Hon. Asst. Secretary:* Alan H. Owen.

NEWCASTLE CENTRE.

Chairman: A. J. Ogle. *Vice-Chairman:* J. S. McCulloch. *Hon. Treasurer:* R. H. Bell. *Committee:* L. Charlton, K. V. Draycott, W. H. Dodgson, C. Fielding, T. C. Gray, H. L. James, G. Kingsley Lark, A. S. Lowrey, W. H. T. Smithson. *Hon. Secretary:* G. R. Hanson, 4, Archbold Terrace, Newcastle-on-Tyne.

NOTTINGHAM CENTRE.

Chairman: R. H. Ellis. *Vice-Chairman:* G. C. Small. *Hon. Treasurer:* P. L. Ross. *Committee:* C. S. Caunt, G. F. King, A. R. Law, W. K. Martin, R. G. Mountford, E. G. Phillips, R. J. Pickford, J. B. Sanderson, F. Walker. *Hon. Secretary:* A. Hacking, 32, St. Leonard's Drive, Wollaton, Nottingham.

SHEFFIELD CENTRE.

Chairman: H. B. Leighton. *Vice-Chairman:* J. A. Whittaker. *Hon. Treasurer:* C. Hadfield. *Committee:* J. G. Charlton, H. Dick, D. H. Fox, L. A. France, B. B. Hayter, E. Marrison, W. H. Thompson, G. L. Tomlinson, H. F. Walker, H. Wheeler. *Hon. Secretary:* E. G. R. Taylor, British Thomson-Houston Co. Ltd., Campo Lane, Sheffield.

Groups:

BRADFORD GROUP.

Chairman: W. B. Jamieson. *Committee:* T. N. Hird, H. Moss, W. H. Naylor, A. S. Redvers Pratt, N. Rhodes, L. Robinson, J. H. Rogerson, F. S. Warburton. *Joint Hon. Secretaries:* A. J. Hutchison, 45/53, Sunbridge Road, Bradford; W. H. Naylor, 40, Godwin Street, Bradford.

EXETER GROUP.

Chairman: F. D. Newcombe. *Committee:* D. R. Beckett, H. H. Brown, W. E. Browning, H. T. Corrigan, L. D. H. Rowe, F. W. Sansom. *Hon. Secretary:* L. W. Cornish, 46, North Street, Exeter.

HUDDERSFIELD GROUP.

Chairman: M. E. Broadbent. *Vice-Chairman:* H. Walton. *Committee:* F. Eastwood, R. Hardy, G. Ripley, N. Schofield, E. G. Scholey, E. C. J. Swabey, J. T. Thornton, H. L. Walker. *Hon. Secretary:* E. Wood, 11, Long Grove Avenue, Dalton, Huddersfield.

SWANSEA GROUP.

Chairman: G. J. Higgs. *Vice-Chairman:* J. D. Callaway. *Committee:* G. Carruthers, J. H. Parker, A. S. Pitman. *Hon. Secretary and Treasurer:* F. M. Macpherson, 5, Northampton Gardens, Swansea.

TEES-SIDE GROUP.

Chairman: R. W. Oxley. *Vice-Chairman:* M. A. Raisbeck. *Hon. Treasurer:* G. Cross. *Committee:* H. L. Chuck, D. J. Furneaux, D. B. Hogg, N. Hunter, J. Kirby, W. C. Mills. *Hon. Secretary:* K. Graham, British Thomson-Houston Co. Ltd., Post Office Buildings, Marton Road, Middlesbrough.

Printed by ARGUS PRESS LTD., Temple-avenue and Tudor-street, London, E.C.4., England.